Replacement Sheet

METHOD FOR MEASURING LIQUID HYDROCARBONS USING REFRACTIVE INDEX

FIELD OF THE INVENTION

The present invention relates to an apparatus and method for measuring the content of water in unrefined hydrocarbons such as an emulsion of water and oil.

BACKGROUND OF THE INVENTION

The process industries including chemical, pharmaceutical, and oil and gas industries, use numerous analytical techniques for research, quality control, production and accounting purposes. In the oil and gas industry many types of oils and emulsions and other materials can be characterized through the measurement and co-relation of a number of different fundamental properties such as temperature, pressure, density, dielectric constants, conductivity, refractive index, viscosity, elemental composition, and other properties.

Hydrocarbon processing plants, transmission pipelines, and many other facilities require quantitative monitoring of fluid flow. In the oil and gas industry, some of the most critical applications of flow measurement are undertaken by companies involved in fiscal transactions that are associated with the transfer of hydrocarbon gas, or liquid, from a seller to a buyer. The measurement of oil and water flow is one specific instance that is often used as a basis for commerce between oil and gas producers, transporters and distributors.

The effect of temperature on the density of oil has been well established and has been documented in published industrial standards over many years. As the temperature of oil increases, its density decreases. It is well known that the dielectric constant of oil varies with density. It also varies with temperature because the density varies with temperature. Due to the effect of variables upon the accuracy of the dielectric constant, an apparatus and means of establishing the water content of an emulsion that does not utilize a dielectric constant may be more accurate than the existing systems.

SUMMARY OF THE INVENTION

In accordance with a broad aspect of the present invention, there is provided an apparatus for measuring the content of water in an emulsion including hydrocarbons and water, the apparatus comprising: a conduit through which the emulsion may flow from a first point to a second point; at least one measurement device configured to measure density and capacitance of the emulsion within the conduit to generate a density value and a capacitance value; and a computing device configured for receiving the density value and the capacitance value from the at least one measurement device and the computing device being configured for determining the content of water in the emulsion through the application of a refractive index in relation to the density value and the capacitance value.

In accordance with a broad aspect of the present invention, there is provided a method for measuring the content of water in an emulsion including hydrocarbons and water, the method comprising: providing at least one measurement device for obtaining a density value and a capacitance value from the emulsion; providing a computing device capable of receiving the density value and the capacitance value from the at least one measurement device; and using